I. SID RESPONSE TO BENCHMARKING LIST

The reduced benchmarking list of 7+1 processes described in section IV of http://arxiv.org/pdf/hep-ex/0603010 (page 9) has been proposed as the starting point for the list of common LOI benchmarks. The SiD proposes that the list be pared down a little, and that physics observables be defined explicitly for each process. The SiD recommends the following for the common LOI physics benchmarks:

0. Single $e^{\pm}$, $\mu^{\pm}$, $\pi^{\pm}$, π^0, $K^{\pm}$, K_s^0, γ, u, s, c, b, W, Z; $0 < |\cos\theta| < 1$, $0 < p < 500$ GeV

Measure identification efficiency, misidentification efficiency, and energy resolution as a function of $|\cos\theta|$ and particle energy. Note that W and Z bosons have been added to the list; only light quark decays of the W and Z bosons should be considered.

1. $e^+e^- \to f\bar{f}$, $f = \mu$, c, τ at $\sqrt{s}$=1.0 TeV;

The muon pair final state is used to measure the luminosity-weighted center-of-mass energy. This will challenge the momentum measurement of very high energy charged particles in both the central and forward regions.

The $c\bar{c}$ final state is used to examine the coupling of the charm quark to a 7 TeV Z' boson through the measurement of the charm quark left-right and forward-backward asymmetries, A_{LR} and A_{FB} . This measurement requires good vertex detector performance to isolate charm jets and to measure the charm quark charge.

The $\tau^+\tau^-$ final state is used to extract the vector and axial-vector couplings of the tau lepton to a 7 TeV Z' boson through tau polarization measurements. These measurements will test the performance of the EM calorimeter, as well as the vertex detector.

2. $e^+e^- \to Zh$, $\to \ell^+\ell^- X$, $m_h = 120$ GeV at $\sqrt{s}$=0.25 TeV;

Classic measurement of Higgs mass and $\sigma(e^+e^- \to Zh)$. Note the center-of-mass energy.

3. $e^+e^- \to Zh$, $h \to \mu^+\mu^-$, $m_h = 120$ GeV at $\sqrt{s}$=0.25 TeV;

Measure the signal significance and branching fraction for the rare Higgs decay $H \to \mu^+\mu^-$. Another challenge for the measurement of charged particle momentum.

4. $e^+e^- \to Zhh \to qqbbbb$, $m_h = 120$ GeV at $\sqrt{s}$=0.5 TeV;

Measure the triple Higgs coupling. Excellent benchmark for intergrated detector performance. Tests ability of detector to measure jet-jet masses and separate b and c jets. A measurement of the b quark charge may also come into play.

6. $e^+e^- \to \tilde{\tau}_1\tilde{\tau}_1$, at Point 3 at $\sqrt{s}$=0.5 TeV;

Measure the mass of the stau lepton and $\sigma(e^+e^- \to \tilde{\tau}_1\tilde{\tau}_1)$. Classic low visible energy benchmark which challenges the far forward detector and many other detector components.

7. $e^+e^- \to \chi_1^+\chi_1^- / \chi_2^0\chi_2^0$ at Point 5 at $\sqrt{s}$=0.5 TeV;

Measure the mass of the second lightest neutralino χ_2^0 and $\sigma(e^+e^- \to \chi_2^0\chi_2^0)$. In this scenario the lightest chargino and second lightest neutralino decay to on-shell W and Z bosons, respectively. This is primarily a W/Z separation benchmark that is used to test calorimeter and PFA performance.

The simulated events should include the SM and machine backgrounds. The concepts should agree on the total integrated luminosity and on the beam polarizations.

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